



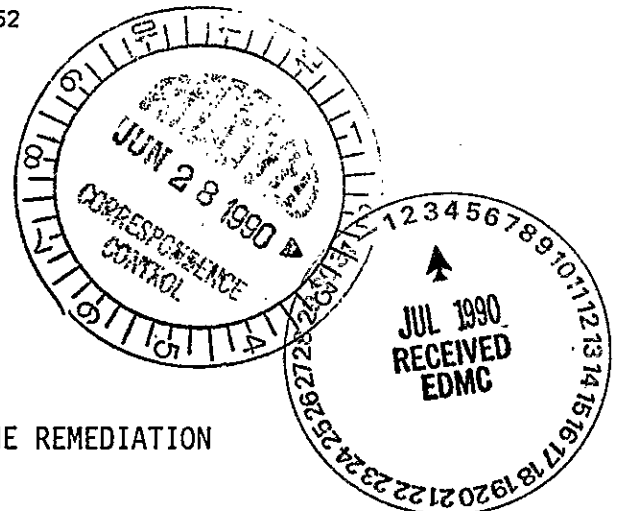
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Department of Energy

9002744

Richland Operations Office
P.O. Box 550
Richland, Washington 99352

JUN 20 1990



Mr. Robert Mooney, Head
Environmental Protection Section
Radiation Protection Division
Department of Health
Airdustrial Park Building 5, LE-13
Olympia, Washington 98504-0095

Dear Mr. Mooney:

AIR EMISSIONS - DISTILLATION PHASE OF THE HEXONE REMEDIATION
DEMONSTRATION ACTIVITY

Transmitted herewith for your information is written notification describing expected changes in air emissions from the Hanford Site Reduction-Oxidation (REDOX) complex that will result from the distillation of 34,000 gallons of tightly radioactively-contaminated hexone presently stored in two single-shell underground storage tanks. The two tanks are buried at the southeastern end of the Hanford Site 200 West Area, just west of the REDOX complex. The planned distillation activity is the first step toward the closure of the tanks under the Resource Conservation and Recovery Act. The distillation activity will cause a temporary change in the rate of emissions from the REDOX complex. The expected duration of the activity is three months, to begin on June 25, 1990.

The distillation activity was discussed briefly at a March 28, 1990, meeting between representatives of the Washington State Department of Health, the U.S. Department of Energy, Richland Operations Office (DOE-RL), and the Westinghouse Hanford Company (WHC). During that meeting, it was determined that the appropriate form of documentation for the distillation activity pursuant to the Clean Air Act (CAA) would be a simple notification detailing the project activities, expected emissions, and offsite dose impacts associated with those emissions.

The enclosed analysis documents the maximum effective dose equivalent, to the theoretical maximally exposed offsite individual, that could potentially result from emissions associated with hexone distillation (Enclosure 1). The offsite dose calculations were performed using both the AIRDOS-PC computer code and the GEN II code. To facilitate your evaluation of the analysis, the input to and output from the GEN II dose code run is also provided (Enclosure 2).

As indicated in the analysis, the use of several very conservative assumptions in the source term and dose calculations resulted in a significant overestimation of the potential offsite dose resulting from distillation activities. The actual effective dose equivalent is expected to be well below the calculated value of 0.013 millirem during the year in which the

START

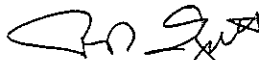
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JUN 20 1990

activity will occur. It is clearly demonstrated in the analysis that the calculated offsite dose associated with the distillation activity will not significantly contribute to the annual Hanford Site offsite dose. It is concluded that no additional documentation pursuant to the CAA is necessary for the hexone distillation phase of the Hexone Remediation Demonstration Activity.

The enclosed information is being provided in response to the March 28, 1990, request for a copy of such documentation. No approval is being sought. If you have any questions regarding this notification, please contact Mr. A. J. Knepp of DOE-RL on (509) 376-1471 or Ms. C. J. Geier of WHC on (509) 376-2237.

Sincerely,



R. D. Izatt, Director
Environmental Restoration Division

Enclosures:

1. Analysis of Air Emissions Resulting
from the Distillation Phase of the
Hexone Remediation Demonstration
Activity
2. GEN II Dose Code Input and Output

cc w/encl.:

P. Cooke, APCA
J. Leitch, EPA
R. E. Lerch, WHC

90113330437

ANALYSIS OF AIR EMISSIONS RESULTING FROM THE DISTILLATION PHASE OF THE HEXONE REMEDIATION DEMONSTRATION ACTIVITY

1.0 INTRODUCTION

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The Westinghouse Hanford Company (WHC), under the direction of the Department of Energy-Richland Operations Office (DOE-RL), is planning to conduct remediation activities on 34,000 gallons of lightly radioactively-contaminated hexone stored in two underground storage tanks in the 200 West Area of the Hanford Site. The remediation strategy consists of two phases. During the first phase, distillation will be used to decontaminate the hexone, producing a nonradioactive liquid distillate and radioactively contaminated, solidified "bottoms." The second phase of remediation will involve either shipping the nonradioactive distillate to a commercial waste handler, or disposing of the material onsite in a portable hazardous waste incinerator. Following hexone disposal, the tank facility will be closed pursuant to regulations promulgated under the Resource Conservation and Recovery Act (RCRA). Only those emissions which will result from distillation activities are addressed in this analysis; additional review pursuant to the Clean Air Act will be conducted as necessary for the incineration phase. Distillation activities will result in the emission of extremely small quantities of radioactivity to the air.

The planned distillation/decontamination activity is the first step toward the RCRA closure of underground storage tanks 276-S-141 and 276-S-142, which are buried at the southeastern end of the 200 West Area, just west of the Reduction-Oxidation (REDOX) complex. Each tank is a 23,500-gallon capacity carbon steel vessel. The organic and aqueous waste material in both tanks has been in storage since the REDOX complex was deactivated in the late 1960's, and a RCRA Dangerous Waste Part A Application has been filed for storage in these tanks. The planned distillation activity will cause a temporary change in the rate of emissions from the REDOX complex.

2.0 PROCESS DESCRIPTION

All distillation activities are to be conducted out doors in a closed process system. The hexone distillation equipment, installed as a self-contained package on a railroad flat car, will be connected with temporary piping to the hexone tanks and to four railroad tank cars that will store the distilled, decontaminated hexone prior to waste incineration. Direct distillation of the wastes will be employed in a two-stage mode with high efficiency mist elimination. A brief description of the distillation process follows.

Wastes stored in the less contaminated of the two tanks, 276-S-141, will be processed first, followed by wastes in tank 276-S-142. Liquid waste will be continuously pumped from the underground tanks to a small recirculation chamber that maintains the distillation vessel liquid level. The process flow rate through the distillation vessels will be 1 to 3 gallons per minute. The two distillation vessels will be heated to approximately 150°C by a

9 0 1 1 3 3 1 0 4 9 9

recirculating hot oil system, with pipe coils in the vessels. Vapors from the first vessel will pass through a high-efficiency demister to remove entrained droplets, and an air-cooled condenser. The condensate will drain to the second distillation vessel, where it is again evaporated, passed through a demister, and condensed. The condensate/final distillate will be collected in a catch tank and pumped to the railroad storage cars. Any overflow liquid produced during distillation and all gases displaced during distillation activities will be routed back to the underground tanks.

The distillation process will be operated in a controlled atmosphere achieved by inducing a constant nitrogen purge gas flow (of approximately 10 cubic feet per hour) at several points in the distillation system. In addition, a nitrogen demand system will be installed at the tank 276-S-142 outlet, before the filtration equipment described below in Section 3.0, to keep the tank/ventilation system at a positive pressure with respect to the atmosphere and to prevent oxygen from entering the system. This additional nitrogen flow will vary depending on barometric pressure changes. The normal rate of gaseous emissions due to the nitrogen purge gases and to non-condensable offgases is expected to be 20 to 30 cubic feet per hour.

The project is currently scheduled to start on June 25, 1990, and the expected duration of the project is three months. During that period, actual processing is scheduled to occur 24 hours per day, Monday through Friday. It is estimated that 300 to 400 hours of actual processing time will be required, with the remainder of the time provided for vessel change-outs and maintenance. Nitrogen purge gas flow will continue during equipment down times.

3.0 EFFLUENT CONTROL AND MONITORING SYSTEMS

During hexone distillation activities, the offgas vent of tank 276-S-141 will be connected to tank 276-S-142, which will in turn vent through a series of filters to the atmosphere. The process offgases and purge gases will pass through both underground tanks before release, maximizing condensation and maintaining the tanks at a positive pressure with respect to the atmosphere. The emissions control system will consist of a single stage of high-efficiency particulate air (HEPA) filtration, followed by two parallel branches of three charcoal adsorbers in series (three per branch). The HEPA filter will have a minimum installed efficiency of 99.97%. Each charcoal adsorber will contain 110 pounds of charcoal, and the efficiency of the activated charcoal system is estimated at 99% removal of gaseous iodine (Elder et al. 1986).

Conventional monitoring of the gaseous emissions from the distillation system would be difficult because of the extremely low flow rates expected. Grab-type sampling of the tank 276-S-142 vent emissions will be performed at a specified frequency to provide periodic confirmatory measurement. In addition, ambient air sampling will be performed periodically in the immediate area. Sampling will be conducted for both hexone vapors and for radionuclides. The exact sampling methods and frequencies are presently under development and will be finalized prior to initiation of the distillation activity.

4.0 WASTE INVENTORY

The waste hexone presently stored in the underground tanks is characterized as mixed (radioactive and hazardous) waste. The source of radiological contamination is mixed fission products derived from the REDOX process. Typical mixed fission products that can be expected to be present in the liquid waste include hydrogen-3 (tritium), carbon-14, nickel-63, selenium-79, strontium-90, niobium-94, technetium-99, plutonium-238, -239, and -240, americium-241, curium-244, and uranium-234, -235, and -238. Sampling and analysis activities in 1976 and 1987 provided the following information on the contained waste (WHC 1988).

Tank 276-S-141 contains 20,000 gallons of essentially pure liquid hexone (methyl isobutyl ketone), contaminated with small amounts of fission products. The hexone is contaminated with a total of 2.3 E-06 Curies of alpha-emitting isotopes and a maximum total of 4.13 E-04 Curies of beta-emitting isotopes. Most of the beta activity is attributable to iodine-129.

Tank 276-S-142 contains 14,000 gallons of a liquid organic mixture (consisting of 65% hexone, 25% normal paraffin hydrocarbon, 9% tri-butyl phosphate, and 1 to 2% dissolved water) and 2,000 gallons of radioactively contaminated water. The radioactive inventory of the liquid in this tank is 1.08 E-01 Curies of total alpha-emitting isotopes and 1.40 E-01 Curies of total beta-emitting isotopes, of which 1.80 E-03 Curies are attributable to iodine-129 in the organic mixture.

5.0 SOURCE TERM AND OFFSITE DOSE CALCULATION

The methodology used to determine the source term input to the dose calculation followed guidance in Appendix D of 40 CFR 61 (EPA 1989). According to this methodology, because the contents of the tanks will pass through the distillation vessels and be heated to above 100°C , it must be assumed that the entire radioactive inventory of the liquid waste will be released upstream of the emissions control system. In reality, most of the radionuclide content of the liquid waste will not be volatilized, but will instead be concentrated into a solid that will remain in the bottoms of the distillation vessels. In addition, the processed waste will be condensed back into a liquid phase within the distillation system.

It was assumed for the source term calculation that all alpha-emitting isotopes released to the emissions control equipment will be particulates. Hence, an emissions adjustment factor of 0.01, for HEPA filtration, was applied to the total alpha content of the liquid waste (1.08 E-01 Curies). The alpha input to the dose calculation was, therefore, 1.1 E-03 Curies.

For the beta-emitting isotopes, a more conservative approach was taken, since a significant portion of the beta-emitting isotopes could theoretically be released to the emissions control equipment as gases. No emissions adjustment factor was applied to any portion of the total beta content of the liquid waste; therefore, the beta input to the dose calculation was 1.4 E-01 Curies.

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The adjusted alpha-emitting isotopic inventory and the total beta-emitting isotopic inventory were used to estimate the effective dose equivalent (EDE), to a theoretical maximally exposed offsite individual, resulting from radiological emissions from hexone distillation activities. The dose calculations used the U.S. Environmental Protection Agency-approved AIRDOS-PC dose code. For the purposes of dose modeling only, all alpha activity was conservatively assumed to be due to plutonium-239, and all beta activity due to iodine-129. This assumption provides an estimate of the maximum potential EDE resulting from hexone distillation. The offsite EDE associated with hexone distillation was thus calculated to be 0.013 millirem during the year in which the activity will occur.

6.0 CONCLUSIONS

The whole body dose to the theoretical maximally exposed offsite individual resulting from emissions from all Hanford Site activities during 1988 was 0.3 millirem, which is well below the Hanford Site limit of 10 millirem per year (Jaquish et al. 1989; EPA 1989). Calculations of the potential offsite dose impacts of the planned distillation activity clearly demonstrate that no significant contribution to the maximum offsite dose due to Hanford Site operations will occur during routine operation of the hexone distillation equipment. The estimated EDE resulting from hexone distillation was calculated to be 0.013 millirem during the year of the planned activity. However, this dose was calculated using several very conservative assumptions. As previously stated, the vast majority of the radionuclides contained in the liquid waste will remain in the distillation vessel bottoms. One of the few gases which might escape solidification in the bottoms - iodine, a beta-emitting isotope - will be filtered by the extensive charcoal adsorber system. The actual offsite dose resulting from distillation activities will be far below the calculated dose.

This submittal provides written notification of the planned distillation activity about which the Washington State Department of Health (DOH) was originally advised on March 28, 1990. Based on the discussions held between representatives of the DOH, DOE-RL, and WHC on that date, and because the planned activity is temporary and will not result in a significant contribution to the Hanford Site offsite dose, no additional submittals will be provided for this proposal pursuant to the Clean Air Act.

REFERENCES

- Jaquish, R.E., and R.W. Bryce, 1989, *Hanford Site Environmental Report for Calendar Year 1988*, PNL 6825, Pacific Northwest Laboratory, Richland, Washington. (page 4.53)
- Elder, J.C., J.M. Graf, J.M. Dewart, T.E. Buhl, W.J. Wenzel, L.J. Walker, and A.K. Stoker, 1986, *A Guide to Radiological Accident Considerations for Siting and Design of DOE Nonreactor Nuclear Facilities*, LA-10294-MS, Los Alamos National Laboratory, Los Alamos, New Mexico. (page 23)

EPA 1989, *National Emission Standards for Hazardous Air Pollutants*, Title 40
Code of Federal Regulations, Part 61, 54 FR 51654, U.S. Environmental
Protection Agency, Washington, D.C.

WHC 1988, *Hexone Remediation Demonstration Plan for Tanks 276-S-141 and
276-S-142*, WHC-SP-0350, Westinghouse Hanford Company, Richland, Washington.
(page 3; Appendix I)

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Program GENII Input File ##### 8 Jul 88 ####
 Title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2 km
 \GENII\IOL6.in TANK 142-S Created on 04-16-1990 at 15:43

OPTIONS===== Default =====
 F Near-field scenario? (Far-field) NEAR-FIELD: narrowly-focused
 F Population dose? (Individual) release, single site
 F Acute release? (Chronic) FAR-FIELD: wide-scale release,
 Maximum Individual data set used multiple sites
 Complete Complete
 TRANSPORT OPTIONS===== Section EXPOSURE PATHWAY OPTIONS===== Section
 T Air Transport 1 T Finite plume, external 5
 F Surface Water Transport 2 F Infinite plume, external 5
 F Biotic Transport (near-field) 3,4 T Ground, external 5
 F Waste Form Degradation (near) 3,4 F Recreation, external 5
 F Inhalation uptake 5,6
 REPORT OPTIONS===== F Drinking water ingestion 7,8
 F Report AEDE only F Aquatic foods ingestion 7,8
 T Report by radionuclide T Terrestrial foods ingestion 7,9
 T Report by exposure pathway T Animal product ingestion 7,10
 F Debug report on screen T Inadvertent soil ingestion

INVENTORY #####

4 Inventory input activity units: (1-pCi 2-uCi 3-mCi 4-Ci 5-Bq)
 0 Surface soil source units (1- m2 2- m3 3- kg)
 Equilibrium question goes here

Use when	---Release Terms--- transport selected			-----Basic Concentrations----- near-field scenario, optionally				
Release	Surface	Buried		Surface	Deep	Ground	Surface	
Radio-	Air	Water	Waste	Air	Soil	Soil	Water	Water
nuclide	/yr	/yr	/m3	/m3	/unit	/m3	/L	/L
I 129	1.4E-01							
PU239	1.1E-03							

Use when	---Derived Concentrations--- measured values are known			
Release	Terres.	Animal	Drink	Aquatic
Radio-	Plant	Product	Water	Food
nuclide	/kg	/kg	/L	/kg

TIME #####

50 Intake ends after (yr)
 50 Dose calc. ends after (yr)
 1 Release ends after (yr)
 0 No. of years of air deposition prior to the intake period
 0 No. of years of irrigation water deposition prior to the intake period

FAR-FIELD SCENARIOS (IF POPULATION DOSE) #####

0 Definition option: 1-Use population grid in file POP.IN

0 2-Use total entered on this line

NEAR-FIELD SCENARIOS #####

Prior to the beginning of the intake period: (yr)

0 When was the inventory disposed? (Package degradation starts)

0 When was LOIC? (Biotic transport starts)

0 Fraction of roots in upper soil (top 15 cm)

0 Fraction of roots in deep soil

0 Manual redistribution: deep soil/surface soil dilution factor

0 Source area for external dose modification factor (m2)

TRANSPORT #####

====AIR TRANSPORT=====SECTION 1=====

	0-Calculat PM	0	Release type (0-3)
3	Option: 1-Use chi/Q or PM value	F	Stack release (T/F)
	2-Select MI dist & dir	0	Stack height (m)
	3-Specify MI dist & dir	0	Stack flow (m3/sec)
0	Chi/Q or PM value	0	Stack radius (m)
13	MI sector index (1=S)	0	Effluent temp. (C)
24200.0	MI distance from release point (m)	0	Building x-section (m2)
T	Use jf data, (T/F) else chi/Q grid	0	Building height (m)

====SURFACE WATER TRANSPORT=====SECTION 2=====

0 Mixing ratio model: 0-use value, 1-river, 2-lake

0 Mixing ratio, dimensionless

0 Average river flow rate for: MIXFLG=0 (m3/s), MIXFLG=1,2 (m/s),

0 Transit time to irrigation withdrawal location (hr)

If mixing ratio model > 0:

0 Rate of effluent discharge to receiving water body (m3/s)

0 Longshore distance from release point to usage location (m)

0 Offshore distance to the water intake (m)

0 Average water depth in surface water body (m)

0 Average river width (m), MIXFLG=1 only

0 Depth of effluent discharge point to surface water (m), lake only

====WASTE FORM AVAILABILITY=====SECTION 3=====

0 Waste form/package half life, (yr)

0 Waste thickness, (m)

0 Depth of soil overburden, m

====BIOTIC TRANSPORT OF BURIED SOURCE=====SECTION 4=====

T Consider during inventory decay/buildup period (T/F)?

T Consider during intake period (T/F)?

0 Pre-Intake site condition.....

1-Arid non agricultural
2-Humid non agricultural
3-Agricultural

9 0 1 1 3 3 3 3 4 9 4

EXPOSURE #####

====EXTERNAL EXPOSURE=====SECTION 5=====

8766.0 Exposure time: Residential irrigation:
4380.0 Plume (hr) T Consider: (T/F)
0 Soil contamination (hr) 0 Source: 1-ground water
0 Swimming (hr) 2-surface water
0 Boating (hr) 0 Application rate (in/yr)
0 Shoreline activities (hr) 0 Duration (mo/yr)
0 Shoreline type: (1-river, 2-lake, 3-ocean, 4-tidal basin)
0 Transit time for release to reach aquatic recreation (hr)
0 Average fraction of time submersed in acute cloud (hr/person hr)

====INHALATION=====SECTION 6=====

0 Hours of exposure to contamination per year
0 0-No resus- 1-Use Mass Loading 2-Use Anspaugh model
0 pension Mass loading factor (g/m3) Top soil available (cm)

====INGESTION POPULATION=====SECTION 7=====

1 Atmospheric production definition (select option):
0 0-Use food-weighted chi/Q, (food-sec/m3), enter value on this line
1-Use population-weighted chi/Q
2-Use uniform production
3-Use chi/Q and production grids (PRODUCTION will be overridden)
0 Population ingesting aquatic foods, 0 defaults to total (person)
0 Population ingesting drinking water, 0 defaults to total (person)
F Consider dose from food exported out of region (default=F)

Note below: S* or Source: 0-none, 1-ground water, 2-surface water
3-Derived concentration entered above

==== AQUATIC FOODS / DRINKING WATER INGESTION=====SECTION 8=====

F Salt water? (default is fresh)

USE ? FOOD T/F TYPE	TRAN- SIT hr	PROD- UCTION kg/yr	-CONSUMPTION- HOLDUP da	RATE kg/yr	DRINKING WATER
F FISH	0.00	0.0E+00	0.00	0.0	0 Source (see above)
F MOLLUS	0.00	0.0E+00	0.00	0.0	T Treatment? T/F
F CRUSTA	0.00	0.0E+00	0.00	0.0	0 Holdup/transit(da)
F PLANTS	0.00	0.0E+00	0.00	0.0	0 Consumption (L/yr)

====TERRESTRIAL FOOD INGESTION=====SECTION 9=====

USE ? FOOD T/F TYPE	GROW TIME da	--IRRIGATION-- S RATE * in/yr	TIME mo/yr	YIELD kg/m2	PROD- UCTION kg/yr	--CONSUMPTION-- HOLDUP da	RATE kg/yr
T LEAF V	90.00	0 0.0	0.0	1.5	0.0E+00	1.0	30.0
T ROOT V	90.00	0 0.0	0.0	4.0	0.0E+00	5.0	220.0
T FRUIT	90.00	0 0.0	0.0	2.0	0.0E+00	5.0	330.0
T GRAIN	90.00	0 0.0	0.0	0.8	0.0E+00	180.0	80.0

====ANIMAL PRODUCTION CONSUMPTION=====SECTION 10=====

USE ? T/F	FOOD TYPE	---HUMAN---		TOTAL PROD- UCTION kg/yr	DRINK WATER CONTAM FRACT.	-----STORED FEED-----						
		CONSUMPTION RATE kg/yr	HOLDUP da			DIET FRAC- TION	GROW TIME da	-IRRIGATION-- S RATE * in/yr	TIME mo/yr	YIELD kg/m3	STOR- AGE da	
T	BEEF	80.0	15.0	0.00	0.00	0.25	90.0	0	0.0	0.00	0.80	180.0
T	POULTR	18.0	1.0	0.00	0.00	1.00	90.0	0	0.0	0.00	0.80	180.0
T	MILK	270.0	1.0	0.00	0.00	0.25	45.0	0	0.0	0.00	2.00	100.0
T	EGG	30.0	1.0	0.00	0.00	1.00	90.0	0	0.0	0.00	0.80	180.0
						-----FRESH FORAGE-----						
	BEEF					0.75	45.0	0	0.0	0.00	2.00	100.0
	MILK					0.75	30.0	0	0.0	0.00	1.50	0.0

90113330496

GENII Dose Calculation Program
(Version 1.436 29-Jan-90)

Case title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2

km
Executed on: 05/07/90 at 15:49:20

Page A. 1

This is a far-field (wide-scale release, multiple site) scenario.
Release is chronic
Individual dose

THE FOLLOWING TRANSPORT MODES ARE CONSIDERED
Air

THE FOLLOWING EXPOSURE PATHS ARE CONSIDERED:

Finite plume, external
Ground, external
Terrestrial foods ingestion
Animal product ingestion
Inadvertent soil ingestion

THE FOLLOWING TIMES ARE USED:

Intake ends after (yr): 50.0
Dose calculations ends after (yr): 50.0
Release ends after (yr): 1.0

===== FILENAMES AND TITLES OF FILES/LIBRARIES USED =====

Input file name: \GENII\IOL3.in 5-07-90
METABOLIC PARAMETERS----- 8-12-88
RMDLIB - Radionuclide Master Library (29-Aug-88 RAP) 8-29-88
Food Transfer Factor Library - (RAP 29-Aug-88) (UPDATED LEACHING FA 8-29-88
External Dose Factors for GENII in person Sv/yr per Bq/n (28-Aug-88 8-29-88
Internal Yearly Dose Increments (Sv/Bq) 29-Aug-88 RAP 8-29-88
200 AREA - 10 M - Pasquill A - F (1983 - 1987 Average)

----- Release Terms-----

Release	Surface Buried		
Radio-	Air	Water	Source
nuclide	Ci/yr	Ci/yr	Ci/m3
I 129	1.4E-01	0.0E+00	0.0E+00
PU239	1.1E-03	0.0E+00	0.0E+00

===== AIR TRANSPORT =====
 Joint frequency data input.
 2.4E+04 Maximum individual distance from release point (m)
 1.3E+01 Maximum individual sector index (Wind Toward E)
 Ground level release.

===== EXTERNAL EXPOSURE =====
 8.8E+03 Hours of exposure to plume
 4.4E+03 Hours of exposure to ground contamination

===== INGESTION POPULATION =====
 1 Atmospheric production definition: 1 - Use population-weighted chi/Q

===== TERRESTRIAL FOOD INGESTION =====

FOOD TYPE	GROW TIME d	--IRRIGATION--		YIELD kg/m2	PROD- UCTION kg/yr	--CONSUMPTION--	
		S RATE * in/yr	TIME mo/yr			HOLDUP d	RATE kg/yr
Leaf Veg	90.0	0	0.0	1.5		1.0	3.0E+01
Oth. Veg	90.0	0	0.0	4.0		5.0	2.2E+02
Fruit	90.0	0	0.0	2.0		5.0	3.3E+02
Cereals	90.0	0	0.0	0.8		180.0	8.0E+01

===== ANIMAL FOOD INGESTION =====

FOOD TYPE	---HUMAN---		TOTAL PROD- UCTION kg/yr	DRINK WATER CONTAM FRACT.	DIET FRAC- TION	GROW TIME d	---STORED FEED---		YIELD kg/m3	STOR- AGE d
	CONSUMPTION RATE kg/yr	HOLDUP d					---IRRIGATION-- S RATE * in/yr	TIME mo/yr		
Meat	8.0E+01	15.0		0.00	0.3	90.00	0	0.0	0.80	180.0
Poultry	1.8E+01	1.0		0.00	1.0	90.00	0	0.0	0.80	180.0
Cow Milk	2.7E+02	1.0		0.00	0.3	45.00	0	0.0	2.00	100.0
Eggs	3.0E+01	1.0		0.00	1.0	90.00	0	0.0	0.80	180.0
-----FRESH FORAGE-----										
Meat				0.75	45.0	0	0.0	0.0	2.00	100.0
Cow Milk				0.75	30.0	0	0.0	0.0	1.50	0.0

Input prepared by: Joseph Louant

Date: 4/16/90

Input checked by: Paul Rittmann

Date: 6/14/90

GENII Dose Calculation Program
(Version 1.436 29-Jan-90)

Case title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2

km
Executed on: 05/07/90 at 15:49:51

Page B. 1

4.4E-08 Individual chi/Q

GENII Dose Calculation Program
(Version 1.436 29-Jan-90)

Case title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2

km
Executed on: 05/07/90 at 15:53:03

Page C. 1

Release period: 1.0
Uptake/exposure period: 50.0
Dose commitment period: 50.0
Dose units: Rem

Organ	Committed Dose Equivalent	Weighting Factors	Weighted Dose Equivalent
Gonads	1.2E-07	2.5E-01	3.0E-08
Breast	2.8E-07	1.5E-01	4.2E-08
R Marrow	6.1E-07	1.2E-01	7.4E-08
Lung	1.4E-07	1.2E-01	1.7E-08
Thyroid	2.3E-03	3.0E-02	6.8E-05
Bone Sur	1.6E-06	3.0E-02	4.9E-08
Bladder	3.7E-07	6.0E-02	2.2E-08
Stomach	1.6E-07	6.0E-02	9.7E-09
LL Int.	1.5E-07	6.0E-02	8.8E-09
S Int.	1.3E-07	6.0E-02	7.9E-09
UL Int.	1.3E-07	6.0E-02	7.6E-09
Internal Effective Dose Equivalent			6.8E-05
External Dose			8.7E-10
Annual Effective Dose Equivalent			6.8E-05

Controlling Organ: Thyroid
Controlling Pathway: Ing
Controlling Radionuclide: I 129

Total Inhalation EDE: 0.0E+00
Total Ingestion EDE: 6.8E-05

Page C. 2

Release period:	1.0
Uptake/exposure period:	50.0
Dose commitment period:	50.0
Dose units:	Rem

		Dose Commitment Year					
		1	2	3	...		
Internal Intake Year:	3	5.7E-07				...	
	2	1.3E-06				1.4E-07	...
	1	6.1E-05 + 6.7E-06 + 7.3E-07 + ...				= 6.8E-05	Internal Effective Dose Equivalent
Internal Annual Dose		6.1E-05 + 7.9E-06 + 1.4E-06 + ...				= 7.1E-05	Cumulative Internal Dose
External Annual Dose		8.7E-10 + 3.9E-10 + 1.8E-10 + ...				= 1.6E-09	
Annual Dose		6.1E-05 + 7.9E-06 + 1.4E-06 + ...				= 7.1E-05	Cumulative Dose
						6.1E-05	Maximum Annual Dose Occurred In Year 1

 GENII Dose Calculation Program
 (Version 1.436 29-Jan-90)

Case title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2

Executed on: 05/07/90 at 15:53:03

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 Release period: 1.0
 Uptake/exposure period: 50.0
 Dose commitment period: 50.0
 Dose units: Rem

Committed Dose Equivalent by Exposure Pathway

Pathway	Lung	Stomach	S Int.	UL Int.	LL Int.	Bone Su	R Marro	Testes
-----	-----	-----	-----	-----	-----	-----	-----	-----
Leaf Veg	1.2E-08	1.4E-08	1.1E-08	1.1E-08	1.5E-08	2.1E-07	5.8E-08	1.1E-08
Oth. Veg	1.9E-08	2.1E-08	1.8E-08	1.8E-08	2.2E-08	3.1E-07	8.9E-08	1.7E-08
Fruit	1.9E-08	2.2E-08	1.8E-08	1.8E-08	2.3E-08	3.2E-07	9.1E-08	1.7E-08
Cereals	6.7E-09	7.7E-09	6.4E-09	6.3E-09	8.0E-09	1.1E-07	3.2E-08	6.0E-09
Meat	6.2E-09	7.1E-09	5.8E-09	5.3E-09	5.8E-09	4.9E-08	2.5E-08	4.9E-09
Poultry	3.2E-12	3.7E-12	3.0E-12	2.8E-12	3.0E-12	2.5E-11	1.3E-11	2.5E-12
Cow Milk	7.8E-08	8.9E-08	7.2E-08	6.7E-08	7.2E-08	6.1E-07	3.2E-07	6.1E-08
Eggs	8.3E-10	9.5E-10	7.7E-10	7.1E-10	7.7E-10	6.5E-09	3.4E-09	6.5E-10
Soil Ing	1.5E-11	1.7E-11	1.4E-11	1.5E-11	2.0E-11	3.4E-10	7.8E-11	1.5E-11
-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	1.4E-07	1.6E-07	1.3E-07	1.3E-07	1.5E-07	1.6E-06	6.1E-07	1.2E-07

Pathway	Ovaries	Muscle	Thyroid	Bladder	Liver
-----	-----	-----	-----	-----	-----
Leaf Veg	1.0E-08	2.4E-08	1.9E-04	3.1E-08	2.1E-08
Oth. Veg	1.6E-08	3.7E-08	3.0E-04	4.9E-08	2.9E-08
Fruit	1.6E-08	3.8E-08	3.1E-04	5.1E-08	2.9E-08
Cereals	5.8E-09	1.3E-08	1.1E-04	1.8E-08	1.1E-08
Meat	5.3E-09	1.2E-08	1.0E-04	1.6E-08	1.0E-11
Poultry	2.8E-12	6.4E-12	5.2E-08	8.5E-12	4.3E-14
Cow Milk	6.7E-08	1.6E-07	1.2E-03	2.1E-07	1.1E-12
Eggs	7.1E-10	1.7E-09	1.3E-05	2.2E-09	3.8E-12
Soil Ing	1.3E-11	3.0E-11	2.4E-07	4.0E-11	3.8E-11
-----	-----	-----	-----	-----	-----
Total	1.2E-07	2.8E-07	2.3E-03	3.7E-07	9.0E-08

External Dose by Exposure Pathway

Pathway	
-----	-----
Plume	2.0E-11
Sur Soil	8.5E-10
-----	-----
Total	8.7E-10

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 GENII Dose Calculation Program
 (Version 1.436 29-Jan-90)

Case title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2

Executed on: 05/07/90 at 15:53:03

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 Release period: 1.0
 Uptake/exposure period: 50.0
 Dose commitment period: 50.0
 Dose units: Rem

Cumulative Internal Dose to Organs by Exposure Pathway

Pathway	Lung	Stomach	S Int.	UL Int.	LL Int.	Bone Su	R Marro	Testes
Leaf Veg	1.2E-08	1.4E-08	1.1E-08	1.1E-08	1.5E-08	2.1E-07	5.8E-08	1.1E-08
Oth. Veg	2.0E-08	2.3E-08	1.9E-08	1.9E-08	2.4E-08	3.3E-07	9.6E-08	1.8E-08
Fruit	2.1E-08	2.4E-08	2.0E-08	2.0E-08	2.5E-08	3.3E-07	9.9E-08	1.9E-08
Cereals	7.2E-09	8.3E-09	6.8E-09	6.7E-09	8.5E-09	1.2E-07	3.4E-08	6.4E-09
Meat	6.3E-09	7.2E-09	5.8E-09	5.4E-09	5.8E-09	4.9E-08	2.6E-08	4.9E-09
Poultry	3.4E-12	3.9E-12	3.2E-12	2.9E-12	3.2E-12	2.7E-11	1.4E-11	2.7E-12
Cow Milk	7.9E-08	9.0E-08	7.3E-08	6.7E-08	7.3E-08	6.2E-07	3.2E-07	6.2E-08
Eggs	8.9E-10	1.0E-09	8.2E-10	7.6E-10	8.2E-10	7.0E-09	3.6E-09	7.0E-10
Soil Ing	2.7E-11	3.8E-11	4.3E-11	1.2E-10	3.4E-10	6.3E-09	5.8E-10	9.3E-11
Total	1.5E-07	1.7E-07	1.4E-07	1.3E-07	1.5E-07	1.7E-06	6.4E-07	1.2E-07

Pathway	Ovaries	Muscle	Thyroid	Bladder	Liver
Leaf Veg	1.0E-08	2.4E-08	1.9E-04	3.2E-08	2.1E-08
Oth. Veg	1.7E-08	4.1E-08	3.3E-04	5.4E-08	2.9E-08
Fruit	1.8E-08	4.2E-08	3.4E-04	5.6E-08	2.9E-08
Cereals	6.2E-09	1.4E-08	1.2E-04	1.9E-08	1.1E-08
Meat	5.4E-09	1.3E-08	1.0E-04	1.7E-08	1.0E-11
Poultry	2.9E-12	6.9E-12	5.5E-08	9.1E-12	4.3E-14
Cow Milk	6.7E-08	1.6E-07	1.3E-03	2.1E-07	1.1E-12
Eggs	7.6E-10	1.8E-09	1.4E-05	2.3E-09	3.8E-12
Soil Ing	2.3E-11	5.4E-11	4.4E-07	7.2E-11	1.2E-09
Total	1.3E-07	2.9E-07	2.4E-03	3.9E-07	9.1E-08

External Dose by Exposure Pathway

Pathway	
Plume	2.0E-11
Sur Soil	1.6E-09
Total	1.6E-09

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Case title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2

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Rem

Radionuclide	
I 129	8.7E-10
PU 239	2.9E-14
Total	8.7E-10

GENII Dose Calculation Program
(Version 1.436 29-Jan-90)

Case title: HEXONE -- OFFSITE -- CHRONIC -- LONG TERM EFFECTS -- E 24.2
km

Executed on: 05/07/90 at 15:53:03

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Release period: 1.0
Uptake/exposure period: 50.0
Dose commitment period: 50.0
Dose units: Rem

Cumulative Internal Dose to Organs by Radionuclide

Radionuclide	Lung	Stomach	S Int.	UL Int.	LL Int.	Bone Su	R Marro	Testes
I 129	1.5E-07	1.7E-07	1.4E-07	1.3E-07	1.4E-07	1.2E-06	6.0E-07	1.2E-07
PU 239	2.2E-13	3.5E-10	8.8E-10	5.0E-09	1.6E-08	5.2E-07	4.0E-08	6.5E-09
Total	1.5E-07	1.7E-07	1.4E-07	1.3E-07	1.5E-07	1.7E-06	6.4E-07	1.2E-07

Radionuclide	Ovaries	Muscle	Thyroid	Bladder	Liver
I 129	1.3E-07	2.9E-07	2.4E-03	3.9E-07	0.0E+00
PU 239	5.9E-13	2.3E-13	2.2E-13	0.0E+00	9.1E-08
Total	1.3E-07	2.9E-07	2.4E-03	3.9E-07	9.1E-08

External Dose by Radionuclide

Radionuclide	
I 129	1.6E-09
PU 239	1.2E-12
Total	1.6E-09

DISTRIBUTION COVERSHEET

Author RD Izatt/DOE-RL	Addressee Robert Mooney, DOH	Correspondence No. Incoming 9002744
Subject AIR EMISSIONS-DISTILLATION PHASE OF THE HEXONE REMEDIATION DEMONSTRATION ACTIVITY		

Internal Distribution				
Approval	Date	Name	Location	w/att
		Correspondence Control		X
		J. A. Bates	B2-19	X
		R. J. Bliss	B3-04	
		L. E. Borneman	H4-57	X
		L. C. Brown	H4-51	X
		L. P. Diediker	T1-30	X
		W. T. Dixon	B2-35	X
		W. F. Heine	B2-35	X
		C. J. Geier	H4-57	X
		R. J. Landon	B2-19	X
		R. E. Lerch (Assignee)	B2-35	X
		J. J. Luke	H4-57	X
		S. M. McKinney	T1-30	X
		R. S. Pavlina	R2-77	X
		O. R. Rasmussen	R1-51	X
		J. M. Ring	H4-57	X
		R. A. Rowell	B2-15	X
		D. E. Simpson	B3-51	X
		D. R. Speer	R2-77	X
		D. P. Trott	H4-15	X
		B. D. Williamson	B3-15	X
		EDMC/AR	H4-22	X
		JMR/LB	H4-57	X

